

Living Things and the Environment

Objectives

After this lesson, students will be able to

E.1.1.1 Identify the needs that must be met by an organism's surroundings.

E.1.1.2 Identify biotic and abiotic parts of a habitat.

E.1.1.3 Describe the levels of organization within an ecosystem.

Target Reading Skill

Identifying Main Ideas Explain that identifying main ideas and details helps students sort the facts from the information into groups. Each group can have a main topic, subtopics, and details.

Answers

Possible answers:

Main Idea: An organism obtains food, water, shelter, and other things it needs from its environment.

Detail: Each organism must live in a specific type of environment, called its habitat.

Detail: Organisms live in different habitats because they have different requirements for survival.

Detail: One area may contain many habitats.

All in One Teaching Resources

- [Transparency E1](#)

Preteach

Build Background Knowledge

Experience with Ecosystems

Ask: **What is an ecosystem?** (Students may say that it is a particular type of place with different kinds of organisms living in it. Accept all responses without comment at this time.)

What kinds of ecosystems do you know of? (Students may mention a swamp, desert, seashore, forest, and so on.)

Living Things and the Environment

Reading Preview

Key Concepts

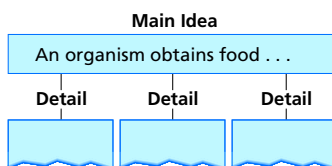
- What needs are met by an organism's surroundings?
- What are the two parts of an organism's habitat with which it interacts?
- What are the levels of organization within an ecosystem?

Key Terms

- organism • habitat
- biotic factor • abiotic factor
- photosynthesis • species
- population • community
- ecosystem • ecology

Target Reading Skill

Identifying Main Ideas As you read the Habitats section, write the main idea—the biggest or most important idea—in a graphic organizer like the one below. Then write three supporting details that give examples of the main idea.



Lab zone

Discover Activity

What's in the Scene?

1. Choose a magazine picture of a nature scene. Paste the picture onto a sheet of paper, leaving space all around the picture.
2. Locate everything in the picture that is alive. Use a colored pencil to draw a line from each living thing. If you know its name, write it on the line.
3. Using a different colored pencil, label each nonliving thing.

Think It Over

Inferring How do the living things in the picture depend on the nonliving things? Using a third color, draw lines connecting the living things to the nonliving things they need.

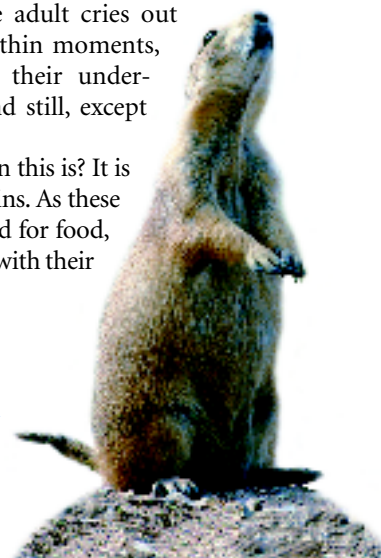


As the sun rises on a warm summer morning, the Nebraska town is already bustling with activity. Some residents are hard at work building homes for their families. They are working underground, where it is dark and cool. Other inhabitants are collecting seeds for breakfast. Some of the town's younger residents are at play, chasing each other through the grass.

Suddenly, an adult spots a threatening shadow—an enemy has appeared in the sky! The adult cries out several times, warning the others. Within moments, the town's residents disappear into their underground homes. The town is silent and still, except for a single hawk circling overhead.

Have you guessed what kind of town this is? It is a prairie dog town on the Nebraska plains. As these prairie dogs dug their burrows, searched for food, and hid from the hawk, they interacted with their environment, or surroundings.

Black-Tailed Prairie Dog ►



Lab zone

Discover Activity

Skills Focus Inferring

Materials old magazines, scissors, paste or glue, sheet of white paper, three pencils of different colors

Time 10 minutes

Tips Encourage students to look for pictures with close-enough views to allow them to distinguish various living and nonliving things.

L1

Expected Outcome The specific living things shown will vary. Students should identify water, soil, sunlight, and air among the nonliving things.

Think It Over Students should indicate that living things need water and air and that plants also need sunlight.



FIGURE 1
An Organism in Its Habitat
 Like all organisms, this red-tailed hawk obtains food, water, and shelter from its habitat. Prairie dogs are a major source of food for the red-tailed hawk.

Habitats

A prairie dog is one type of **organism**, or living thing. Different types of organisms must live in different types of environments. **An organism obtains food, water, shelter, and other things it needs to live, grow, and reproduce from its environment.** An environment that provides the things the organism needs to live, grow, and reproduce is called its **habitat**.

One area may contain many habitats. For example, in a forest, mushrooms grow in the damp soil, salamanders live on the forest floor, and woodpeckers build nests in tree trunks.

Organisms live in different habitats because they have different requirements for survival. A prairie dog obtains the food and shelter it needs from its habitat. It could not survive in a tropical rain forest or on the rocky ocean shore. Likewise, the prairie would not meet the needs of a spider monkey or hermit crab.



Why do different organisms live in different habitats?

Biotic Factors

To meet its needs, a prairie dog must interact with more than just the other prairie dogs around it. **An organism interacts with both the living and nonliving parts of its habitat.** The living parts of a habitat are called **biotic factors** (by AHT ik). Biotic factors in the prairie dogs' habitat include the grass and plants that provide seeds and berries. The hawks, ferrets, badgers, and eagles that hunt the prairie dogs are also biotic factors. In addition, worms, fungi, and bacteria are biotic factors that live in the soil underneath the prairie grass.



Name a biotic factor in your environment.

Instruct

Habitats

Teach Key Concepts

L2

Definition of Habitat

Focus Ask: Are all parts of the forest where organisms live the same? (No) How do they differ? (Possible answers: Some parts get more sunlight than others; some organisms live on the ground, others in the treetops.)

Teach Explain that the type of place where an organism lives—a forest or a prairie, for example—is an ecosystem. The specific part of the ecosystem that meets the organism's needs and in which it lives is its habitat.

Ask: What are some habitats in a forest? (Answers might include: a tree branch; a sunny patch on the forest floor.)

Apply Ask: Why do you find different kinds of organisms in different habitats? (Each kind of organism has specific needs. Different habitats provide different things.)

learning modality: verbal

Biotic Factors

Teach Key Concepts

L2

Identifying Biotic Factors

Focus Remind students that an organism's habitat includes living and nonliving parts.

Teach Explain that the living parts of a habitat are called biotic factors.

Apply Ask: What are some biotic factors in the habitat of a field mouse? (Answers might include: grass and other plants, insects, snakes, or gophers.)

learning modality: verbal

Independent Practice

All in One Teaching Resources

- Guided Reading and Study Worksheet: [Living Things and the Environment](#)



Student Edition Audio CD

Differentiated Instruction

Less Proficient Readers

L1

Building Vocabulary Before students begin reading the lesson, have them skim the text for unfamiliar words. Tell them to record the words and as they read they can write definitions as they encounter the words. After reading, students can use a dictionary to check any definitions they are uncertain of. **learning modality: visual**

Gifted and Talented

L3

Comparing Habitats Have students describe their own habitat and make a list of its biotic factors. Then tell students to explain how these factors differ from those of organisms living in natural habitats. **learning modality: logical/mathematical**

Monitor Progress

L1

Answers



Different kinds of organisms have different requirements. Their habitats must meet the requirements.



Students may name another living organism such as a person, tree, dog, bird, grass, flower.

Abiotic Factors

Help Students Read

Word-Part Analysis Explain that knowing the meanings of prefixes and root words can help students figure out and remember the meaning of key concept words. Write the word *biotic* on the board and ask student to identify the root word. (*Bio*) Tell students that *bio* comes from the Greek *bios*, which means “life.” Next write the word *abiotic* on the board and point out that *a-* is a prefix meaning “not.” Ask students to use the meanings of the prefix and root word to construct a meaning for *abiotic*. (“Not living”)

Teach Key Concepts

Identifying Abiotic Factors

Focus Remind students that biotic factors are the living parts of an organism’s habitat.

Teach Ask: **What are some nonliving parts of a habitat?** (*Water, sunlight, oxygen, temperature, soil*) Define *abiotic factor*. Discuss how each factor helps an organism survive.

Apply Ask: **Does a squirrel need all the abiotic factors in its habitat to survive?** (*No*) Help students identify those that are essential to the squirrel’s survival. (*Water, oxygen, temperature*) Ask students what might happen to a squirrel if its habitat did not provide sufficient amounts of a factor. (*It might die.*) **learning modality: verbal**

L2

Lab zone Build Inquiry

Observing Soil Components

Materials soil sample, jar with screw-on lid, water, metric ruler

Time 10 minutes

Focus Discuss with students the different materials that they might find in soil.

Teach Have small groups of students put about 200 mL of soil into a jar, add water to about 3 cm from the top, and screw on the lid tightly. Tell students to shake the jar thoroughly to mix the soil and water and then place the jar on the desk. When the soil has settled, have students observe the layers of separated soil. Remind student to wash their hands after completing the activity.

Apply Challenge students to identify the materials that make up the soil and to tell which are biotic and which are abiotic.

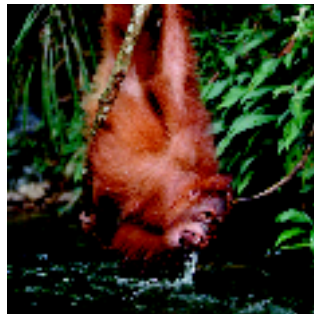
learning modality: kinesthetic

L1

FIGURE 2

Abiotic Factors

The nonliving things in an organism’s habitat are abiotic factors. **Applying Concepts** Name three abiotic factors you interact with each day.



▲ This orangutan is enjoying a drink of water.



▲ Sunlight enables this plant to make its own food.



▲ This banjo frog burrows in the soil to stay cool.

Abiotic Factors

Abiotic factors (ay by AHT ik) are the nonliving parts of an organism’s habitat. They include water, sunlight, oxygen, temperature, and soil.

Water All living things require water to carry out their life processes. Water also makes up a large part of the bodies of most organisms. Your body, for example, is about 65 percent water. Plants and algae need water, along with sunlight and carbon dioxide, to make their own food in a process called **photosynthesis** (foh toh SIN thuh sis). Other living things depend on plants and algae for food.

Sunlight Because sunlight is needed for photosynthesis, it is an important abiotic factor for most living things. In places that do not receive sunlight, such as dark caves, plants and algae cannot grow. Because there are no plants or algae to provide food, few other organisms can live in such places.

Oxygen Most living things require oxygen to carry out their life processes. Oxygen is so important to the functioning of the human body that you can live only a few minutes without it. Organisms that live on land obtain oxygen from air, which is about 20 percent oxygen. Fish and other water organisms obtain oxygen that is dissolved in the water around them.

Temperature The temperatures that are typical of an area determine the types of organisms that can live there. For example, if you took a trip to a warm tropical island, you might see colorful orchid flowers and tiny lizards. These organisms could not survive on the frozen plains of Siberia.

Some animals alter their environments so they can survive very hot or very cold temperatures. Prairie dogs, for example, dig underground dens to find shelter from the hot summer sun and cold winter winds.

Soil Soil is a mixture of rock fragments, nutrients, air, water, and the decaying remains of living things. Soil in different areas consists of varying amounts of these materials. The type of soil in an area influences the kinds of plants that can grow there. Many animals, such as the prairie dogs, use the soil itself as a home. Billions of microscopic organisms such as bacteria also live in the soil.



How do abiotic factors differ from biotic factors?



FIGURE 3
A Population
All these garter snakes make up a population.

Levels of Organization

Of course, organisms do not live all alone in their habitat. Instead, organisms live together in populations and communities, and with abiotic factors in their ecosystems.

Populations In 1900, travelers saw a prairie dog town in Texas that covered an area twice the size of the city of Dallas. The town contained more than 400 million prairie dogs! These prairie dogs were all members of one species, or single kind, of organism. A **species** (SPEE sheez) is a group of organisms that are physically similar and can mate with each other and produce offspring that can also mate and reproduce.

All the members of one species in a particular area are referred to as a **population**. The 400 million prairie dogs in the Texas town are one example of a population. All the pigeons in New York City make up a population, as do all the bees that live in a hive. In contrast, all the trees in a forest do not make up a population, because they do not all belong to the same species. There may be pines, maples, birches, and many other tree species in the forest.

Communities A particular area usually contains more than one species of organism. The prairie, for instance, includes prairie dogs, hawks, grasses, badgers, and snakes, along with many other organisms. All the different populations that live together in an area make up a **community**.

To be considered a community, the different populations must live close enough together to interact. One way the populations in a community may interact is by using the same resources, such as food and shelter. For example, the tunnels dug by prairie dogs also serve as homes for burrowing owls and black-footed ferrets. The prairie dogs share the grass with other animals. Meanwhile, prairie dogs themselves serve as food for many species.

Lab
zone

Try This Activity

With or Without Salt?

In this activity you will explore salt as an abiotic factor.

1. Label four 600-mL beakers A, B, C, and D. Fill each with 500 mL of room-temperature spring water.
2. Set beaker A aside. Add 2.5 grams of noniodized salt to beaker B, 7.5 grams of salt to beaker C, and 15 grams of salt to beaker D. Stir each beaker.
3. Add $\frac{1}{8}$ spoonful of brine shrimp eggs to each beaker.
4. Cover each beaker with a square of paper. Keep them away from direct light or heat. Wash your hands.
5. Observe the beakers daily for three days.

Drawing Conclusions In which beakers did the eggs hatch? What can you conclude about the amount of salt in the shrimps' natural habitat?

Levels of Organization

Teach Key Concepts

L2

Identifying Species, Populations, and Communities

Focus Write the names of these organisms on the board: grass, grasshoppers, field mice, red-tailed hawks. Ask: **Where might you find these organisms living together?** (*In a grassland*)

Teach Tell students that the members of each single kind of organism make up a species. Although the members of a species might have some small differences, they are physically similar and can mate with each other and produce young that can also mate with each other. Ask: **Do all members of each species, such as the red-tailed hawk, live in the same grassland?** (*No*) **What do we call the members of a single species living in this grassland?** (*Population*) **What do we call all the species living together in a grassland?** (*Community*)

Apply Ask: **Would white-tailed deer living in a forest in Pennsylvania be members of the same population as white-tailed deer living in Illinois? Why or why not?** (*No, a population is composed of individuals that live in a particular area.*) **learning modality:** logical/mathematical

Use Visuals: Figure 3

L1

Identifying Populations

Focus Have students study Figure 3 and read the caption.

Teach Ask: **Why is this group of garter snakes a population?** (*Because all the individuals are the same species and they live in the same area*)

Apply Ask students what other populations they might find living in a community with these snakes. (*Possible answers: plants, including grasses; mice; insects*) **learning modality:** verbal

Lab
zone

Try This Activity

Skills Focus Drawing conclusions

L2

Materials 4 600-mL beakers, masking tape, pen, 2 L spring water, 25 g noniodized salt, stirrers, brine shrimp eggs, 4 paper squares, paper cups, hand lens (optional)

Time setup—15 minutes; follow-up—5 minutes per day

Tips Allow the water to sit overnight. Put brine shrimp eggs in a paper cup for each group. Add 1/2 teaspoon of dry yeast to each beaker to feed the shrimp. **NOTE:** Newly hatched brine shrimp are tiny and orange.

Expected Outcome Beaker A, no eggs hatch; beaker B, eggs hatch well; beaker C, less well; beaker D, little or no hatching.

learning modality: kinesthetic

Monitor Progress

L2

Skills Check Have students make a chart that lists abiotic factors in the first column. In the second column they should tell why each factor is necessary for life.

Answers

Figure 2 Answers might include: oxygen, water, temperature, sunlight.

Abiotic Checkpoint Biotic factors are living; abiotic factors are nonliving.

Use Visuals: Figure 4

L2

Diagram Levels of Organization

Focus Review with students the definitions of *population* and *community*.

Teach Have students study Figure 4. Ask: Which level has the most different kinds of individuals? (*Ecosystem*) How many different species are in the population? (*One*) What do the organisms in the community have in common? (*They all live in the same place.*)

Apply Tell students to think of a different ecosystem. Then have each student create a diagram that shows the levels of organization for the chosen ecosystem. **learning modality: visual**

All in One Teaching Resources

- [Transparency E2](#)

Ecosystems The community of organisms that live in a particular area, along with their nonliving surroundings, make up an **ecosystem**. A prairie is just one of the many different ecosystems found on Earth. Other ecosystems in which living things make their homes include mountain streams, deep oceans, and evergreen forests.

Figure 4 shows the levels of organization in a prairie ecosystem. The smallest level of organization is a **single organism**, which belongs to a **population** that includes other members of its species. The **population** belongs to a **community** of different species. The **community** and **abiotic factors** together form an **ecosystem**.

Because the populations in an ecosystem interact with one another, any change affects all the different populations that live there. The study of how living things interact with each other and with their environment is called **ecology**. Ecologists are scientists who study ecology. As part of their work, ecologists study how organisms react to changes in their environment. An ecologist, for example, may look at how a fire affects a prairie ecosystem.



What is ecology?

Section 1 Assessment



Target Reading Skill Identifying Main Ideas

Use your graphic organizer to help you answer Question 1 below.

Reviewing Key Concepts

- Listing** What basic needs are provided by an organism's habitat?
 - Predicting** What might happen to an organism if its habitat could not meet one of its needs?
- Defining** Define the terms *biotic factors* and *abiotic factors*.
 - Interpreting Illustrations** List all the biotic and abiotic factors in Figure 4 on page 11.
 - Making Generalizations** Explain why water and sunlight are two abiotic factors that are important to all organisms.

- Sequencing** List these terms in order from the smallest level to the largest: *population, organism, ecosystem, community*.
 - Classifying** Would all the different kinds of organisms in a forest be considered a population or a community? Explain.
 - Relating Cause and Effect** How might a change in one population affect other populations in a community?

Writing in Science

Descriptive Paragraph What habitat do you live in? Write a one-paragraph description of your habitat. Describe how you obtain the food, water, and shelter you need from your habitat. How does this habitat meet your needs in ways that another would not?

Differentiated Instruction

English Learners/Beginning

L1

Vocabulary: Link to Visual Use Figure 4 to explain levels of organization. Have students identify each kind of organism (species) in their home language and in English. Then pronounce aloud the picture labels: Organism, Population, Community and Ecosystem. Ask students how each level differs. **learning modality: visual**

English Learners/Intermediate

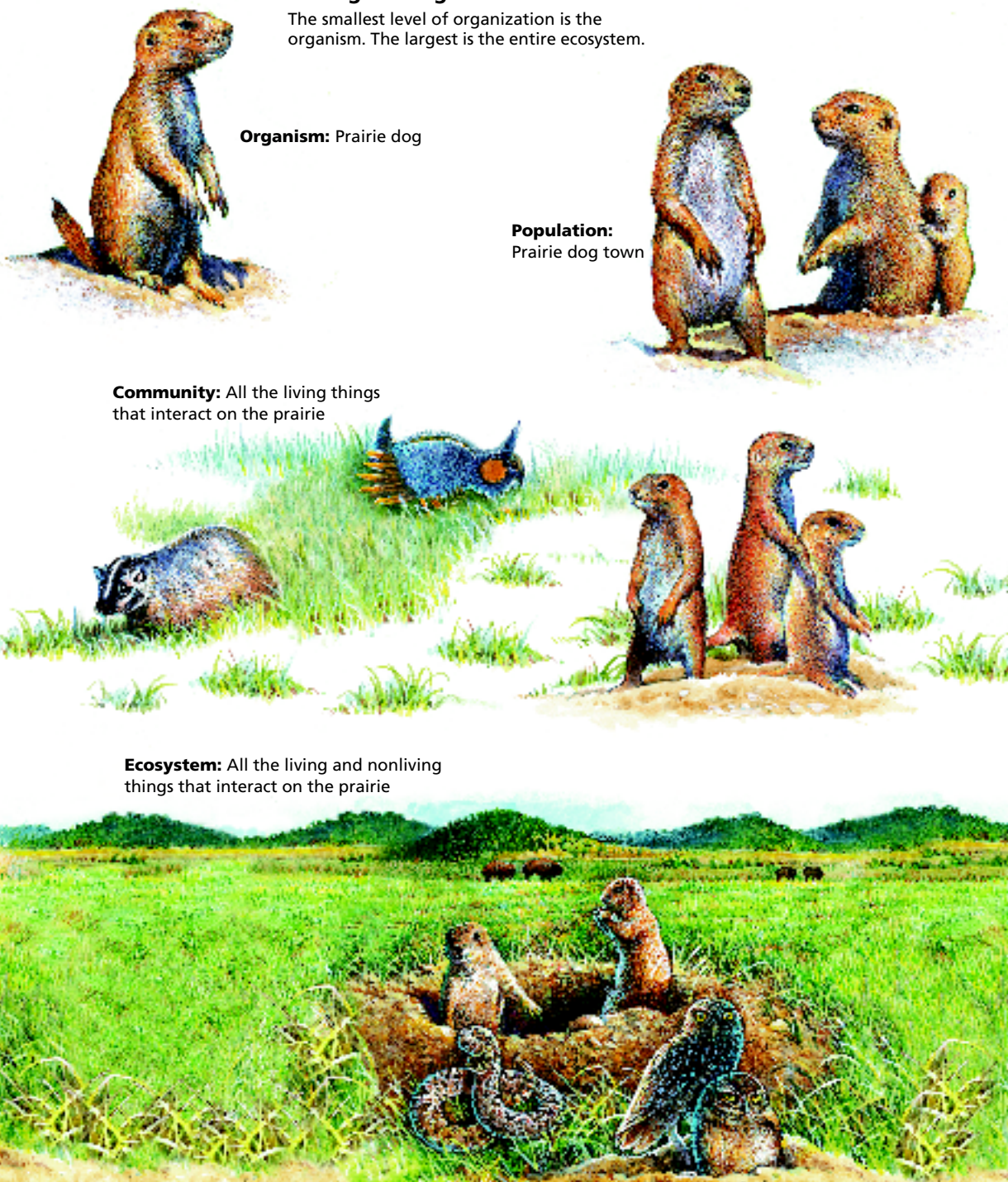
L2

Vocabulary: Link to Visual Repeat the Beginning activity but have students write a sentence to describe what they see in each level. **learning modality: visual**

FIGURE 4

Ecological Organization

The smallest level of organization is the organism. The largest is the entire ecosystem.



Organism: Prairie dog

Population:
Prairie dog town

Community: All the living things that interact on the prairie

Ecosystem: All the living and nonliving things that interact on the prairie

Monitor Progress L1

Answer



Ecology is the study of how living things interact with each other and with their environment.

Assess

Reviewing Key Concepts

1. **a.** A habitat provides food, water, shelter, and other things an organism needs to grow and reproduce. **b.** The organism might die.
2. **a.** Biotic factors are the living parts of a habitat that an organism interacts with; abiotic factors are the nonliving parts. **b.** Biotic—grass, birds, snake, badger, bison, prairie dogs; abiotic—soil, air, temperature, sunlight **c.** All organisms need water to carry on life processes. Plants and algae need sunlight to make food in photosynthesis. Other organisms depend directly or indirectly on the plants and algae for food.
3. **a.** Organism, population, community, ecosystem **b.** A community because a community consists of different populations living together **c.** Sample answer: If a population that is a food source for another population decreases, then the second population may decrease due to starvation.

Reteach L1

Write the word *prairie* on the board and draw a very large circle around it. Inside the circle draw smaller squares with these labels: *hawks, grasses, mice, snakes, water, air*. Inside the mice square, draw smaller triangles and label each *mouse*. Have students identify the shape that represent populations, a community, and an ecosystem.

Performance Assessment L2

Writing Ask students to choose an organism and describe its habitat. Tell them to identify the biotic and abiotic factors in the habitat.

Lab zone Chapter Project

Keep Students on Track Make sure students have identified the major variables that affect plant growth: size of the containers, amount of soil in each, density and depth for planting the seeds, amount and frequency of watering, and location in which the containers will be placed. Also review students' data tables to make sure they will be recording all relevant data.

Writing in Science

Writing Mode Description

Scoring Rubric

- 4 Includes detailed descriptions of what student needs, how the student will get it, and how another habitat would not meet the student's needs
- 3 Includes incomplete descriptions of all three factors
- 2 Includes only two of the three factors
- 1 Includes only one of the factors

All in One Teaching Resources

- [Section Summary: Living Things and the Environment](#)
- [Review and Reinforce: Living Things and the Environment](#)
- [Enrich: Living Things and the Environment](#)

A World in a Bottle

Prepare for Inquiry

Skills Objectives

After this lab, student will be able to

- make a model of a closed system
- observe the interactions of biotic and abiotic factors in a closed system



Prep Time 30 minutes

Class Time 30 minutes followed by 5–10 minutes per day for observations

Safety



Be sure students wear lab aprons to protect their clothing from soil stains. Students who are allergic to molds should not handle the soil. Remind students to wash their hands after they finish the activity. Review the safety guidelines in Appendix A.

All in One Teaching Resources

- [Lab Worksheet: A World in a Bottle](#)

Guide Inquiry

Introducing the Procedure

Have students study the picture of the lab setup in their books. Ask: **Why do you think a layer of gravel is included in the setup?** (The gravel will help prevent the soil from becoming too wet, which could harm the plant.)

Expected Outcome

The plants will grow and thrive as long as not too little and not too much water is provided, and plants receive sunlight. Plants may outgrow the container and become root bound. Plants may start to decline if they become too crowded, or if nutrients in the soil decline.

Analyze and Conclude

1. Biotic factors: plants, any microscopic organisms in the soil; abiotic factors: gravel, soil, charcoal, water, air, light
2. Yes, light, an abiotic factor
3. Diagrams should show plants taking in carbon dioxide, water, and sunlight and giving off oxygen gas and water.

A World in a Bottle

Problem

How do organisms survive in a closed ecosystem?

Skills Focus

making models, observing

Materials

- gravel • soil • moss plants • plastic spoon
- charcoal • spray bottle • large rubber band
- 2 vascular plants • plastic wrap
- pre-cut, clear plastic bottle

Procedure



1. In this lab, you will place plants in moist soil in a bottle that then will be sealed. This setup is called a terrarium. Predict whether the plants can survive in this habitat.
2. Spread about 2.5 cm of gravel on the bottom of a pre-cut bottle. Then sprinkle a spoonful or two of charcoal over the gravel.
3. Use the spoon to layer about 8 cm of soil over the gravel and charcoal. After you add the soil, tap it down to pack it.
4. Scoop out two holes in the soil. Remove the vascular plants from their pots. Gently place their roots in the holes. Then pack the loose soil firmly around the plants' stems.
5. Fill the spray bottle with water. Spray the soil until you see water collecting in the gravel.
6. Cover the soil with the moss plants, including the areas around the stems of the vascular plants. Lightly spray the mosses with water.
7. Tightly cover your terrarium with plastic wrap. Secure the cover with a rubber band. Place the terrarium in bright, indirect light.
8. Observe your terrarium daily for two weeks. Record your observations in your notebook. If its sides fog, move the terrarium to an area with a different amount of light. You may need to move it a few times. Note any changes you make in your terrarium's location.



Analyze and Conclude

1. **Making Models** List all of the biotic factors and abiotic factors that are part of your ecosystem model.
2. **Observing** Were any biotic or abiotic factors able to enter the terrarium? If so, which ones?
3. **Inferring** Draw a diagram showing the interactions between the terrarium's biotic and abiotic factors.
4. **Predicting** Suppose a plant-eating insect were added to the terrarium. Predict whether it would be able to survive. Explain your prediction.
5. **Communicating** Write a paragraph that explains how your terrarium models an ecosystem on Earth. How does your model differ from that ecosystem?

Design an Experiment

Plan an experiment that would model a freshwater ecosystem. How would this model be different from the land ecosystem? *Obtain your teacher's approval before carrying out your plan.*

4. Sample answer: The insect probably would not survive because it would eat the plants faster than they could grow.
5. Paragraphs should explain that the model shows how biotic and abiotic factors interact within an ecosystem. The model is closed, not as complex, contains fewer organisms than an ecosystem.

Extend the Inquiry

Design an Experiment Students should include both plants and animals in their ecosystem. Make sure students let the water stand uncovered for a few days before adding it to the ecosystem to get rid of dissolved chemicals in the water. Water temperature should be maintained around 23°C.